9.1 Baseline Inventory

introduction

To better understand the current and potential sources of air pollution in the Boulder Valley, the City of Boulder recently developed a 1994 base year and 2020 forecasted emissions inventory. The inventories include the following four sources of emissions: **mobile sources** (cars and trucks); **stationary/area sources** (primarily large and small industry and businesses); **woodburning**; and **non-road mobile sources** (aircraft, light commercial, industrial and construction equipment, and lawn and garden equipment).

Both the base year and forecasted emissions include emissions estimates of carbon monoxide, particulate matter (PM10), ozone precursors (nitrogen oxides and hydrocarbons), and sulfur oxides.

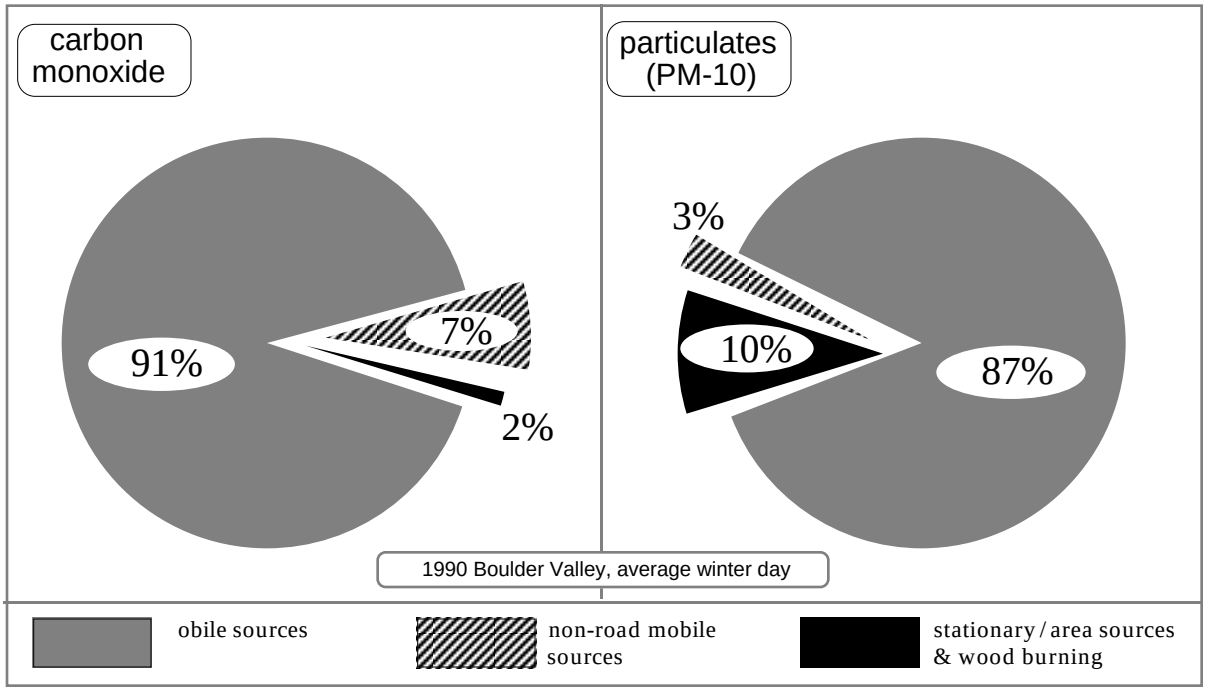
The transportation forecasts shown in chapter 5 were coordinated with the Baseline Analysis and Forecast of mobile source air pollution emissions, both through the TMP Update and through a separate analysis completed as part of the Boulder Air Quality Action Plan.

This section of the TMP discusses the findings of the base year (current) mobile source emissions as well as the forecasts of mobile source emissions which were coordinated with the transportation forecasts shown in chapter 5. This section also provides a brief summary of the key action items proposed in the Air Quality Action Plan.

background

Mobile sources - autos and trucks - are a primary source of air pollution in Boulder Valley. On an average winter day, about 90% of carbon monoxide air pollution and particulate matter in Boulder Valley is generated by motor vehicle exhaust.

igure 9-1. sources of carbon monoxide and particulates



The City of Boulder lies within the boundaries of the Denver non-attainment area for carbon monoxide, ozone and particulate matter.

baseline inventory - mobile source air pollution emissions

carbon monoxide (CO)

Carbon monoxide (CO) is a colorless, odorless and tasteless gas which results from incomplete combustion. CO affects individuals by inhibiting the body's ability to transport oxygen.

Sources in Boulder Valley emit 140 tons of carbon monoxide on an average winter day. Cars and trucks are the largest source of these emissions -- with vehicular exhaust contributing about 90% of total carbon monoxide emissions (figure 9-1).

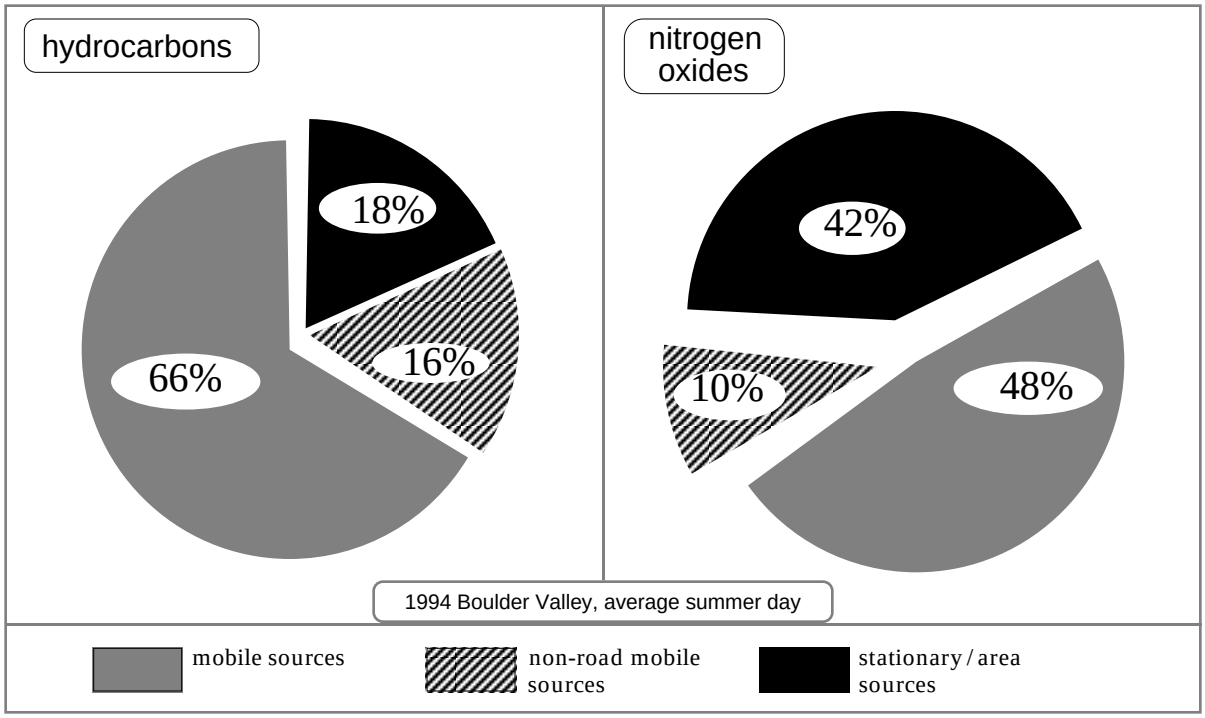
particulate matter (PM10)

Particulate matter (PM10) is a term given to tiny particles of solid or semi-solid material found in the air. PM10 can reduce lung function, aggravate respiratory conditions and may increase the long-term risk of cancer or development of respiratory problems.

Motor vehicles are also the largest source of particulate matter emissions (PM10) -- responsible for about 87% of total emissions (figure 9-1). Road dust and sand thrown into the air from passing vehicles make up the majority (almost 90%) of total PM10 emissions.

Though tailpipe emissions represent only 11% of PM10 mobile source emissions, they are a primary source of fine particulates -- those particles less than 2.5 microns in size which are linked to adverse health effects. Diesel vehicles contribute at least 50% to total tailpipe emissions of fine particulates.

figure 9-2. source of ozone precursors



Fine particulates, along with nitrogen oxides and sulfur oxides -- both precursors to particulate matter -- all contribute to impaired visibility. Although there is currently little information on local levels and source apportionment of fine particulates, it should be noted that planned efforts to bring Denver into compliance with the federal PM10 standard should not significantly improve visibility.

ozone

The summertime air pollutant of concern in Boulder is ozone. Ozone forms as a secondary pollutant when volatile organic compounds and nitrogen oxides react with each other in sunlight.

Exposure to high concentrations of ozone can impair lung function, reduce immune system capacity and irritate the eyes and throat. Two-thirds of Boulder Valley hydrocarbon emissions and half of the nitrogen oxide emissions are attributable to motor vehicles, as shown in figure 9-2 on the previous page.

The City of Boulder lies within the boundaries of the Denver region "transitional non-attainment area" designated by the federal EPA (Environmental Protection Agency). Although the region has not violated the federal standard since 1986, it has not yet been redesignated as an attainment area. The most recent Boulder-area exceedance of the federal standard occurred during the first week of July 1993 at South Boulder Creek near Eldorado Canyon.

air toxics

Present in particulate matter and other emissions air toxics have been shown to have carcinogenic and other adverse effects on human health, including sterility and nervous system disorders.

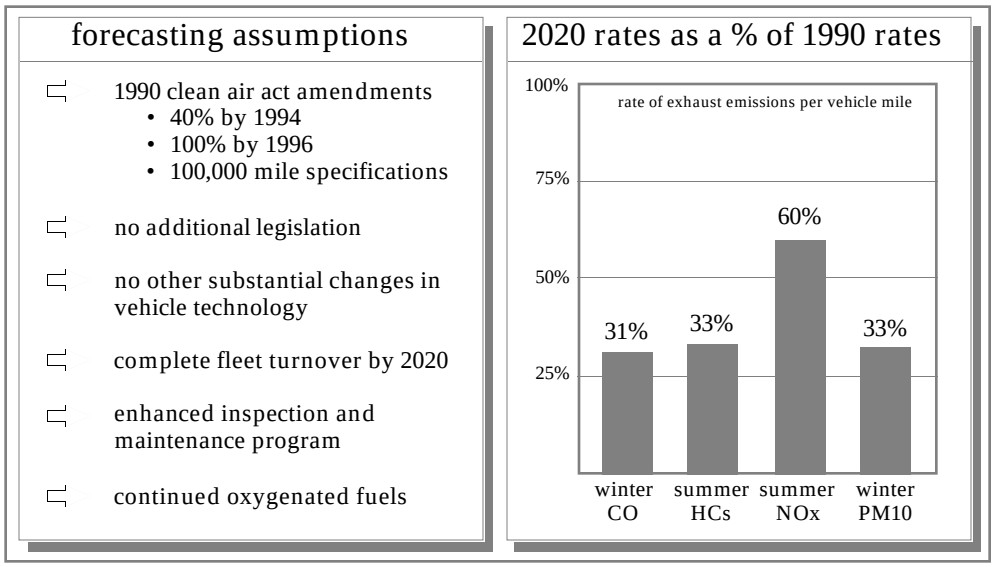
Air toxics associated with mobile sources include: benzene, formaldehyde, 1,3-butadiene, acetaldehyde, diesel particulate matter, gasoline particulate matter, and gasoline vapors.

9.2 Forecasts

forecasts - mobile source air pollution

The assumptions used in forecasting mobile source emissions of air pollutants and precursors are summarized in figure 9-3. By far the most important - and most debatable - assumption is that the 1990 Clean Air Act Amendments will be fully implemented and not rewritten or weakened by Congress.

figure 9-3. basis for mobile source emissions forecasts



Full implementation of the 1990 amendments would have major effects on mobile source emissions. By 2020, the amount of carbon monoxide, hydrocarbons and particulates emitted in vehicle exhaust per mile traveled would be a third or less of today. Nitrogen oxide emission rates would be reduced by 40%.

The 1990 amendments would accomplish this by reducing mobile source emissions rates through technological improvements in vehicles and fuels, and through inspection programs.

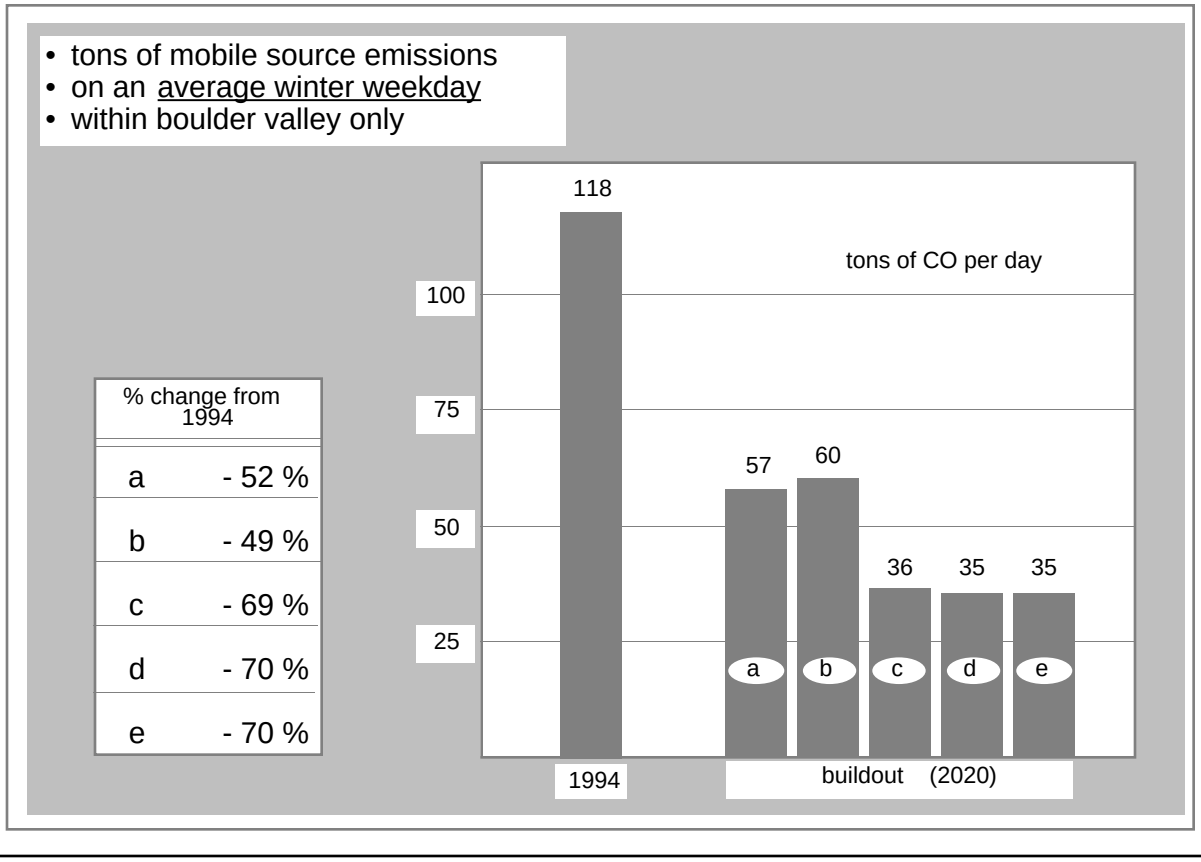
The City Council felt strongly that these assumptions should be carefully monitored since they are tied to uncertain national political trends.

carbon monoxide

Daily emissions of carbon monoxide from motor vehicles in Boulder Valley will decline significantly under all of the TMP Update scenarios. This decline is entirely attributable to the effects of the Clean Air Act Amendments which were targeted toward significant reductions in this pollutant.

Forecasts for carbon monoxide emissions are shown in figure 9-4. It is interesting to note that more detailed trend analysis reveals that CO emissions will "bottom out" sometime around 2005 and could begin to grow again at that time if traffic growth is not curtailed. Emissions in 2020 would still be less than today but some of the investment in lower emission rates would be lost to increasing traffic.

figure 9-4. carbon monoxide forecasts



One effect of this forecast is to reduce the significance of roadway congestion in air quality planning. Carbon monoxide is the only criteria pollutant for which emission rates increase at low vehicle speeds. For this reason CO has provided a primary argument for roadway capacity investments to alleviate congestion. This may no longer be relevant due to expected substantial reductions in CO emission rates.

particulate emissions

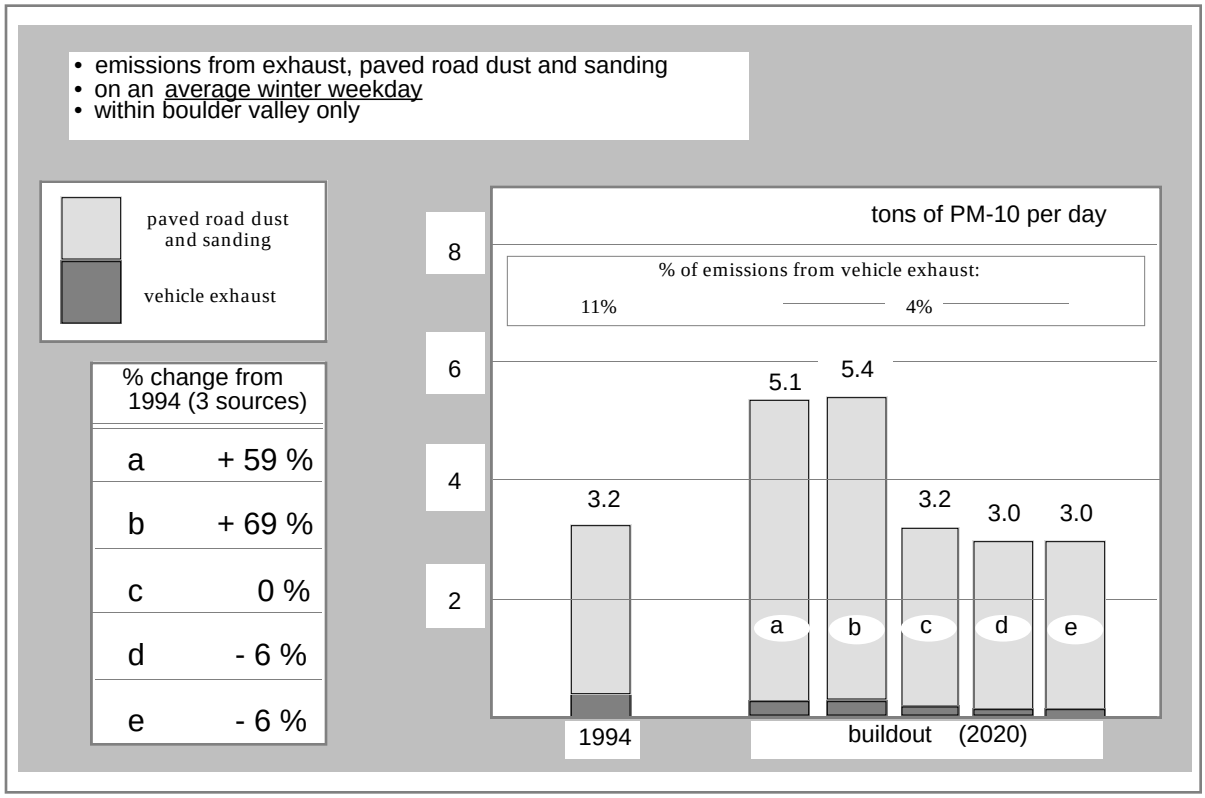
Forecasts of particulate emissions, shown in figure 9-5, are not nearly as favorable.

While tailpipe emission rates of PM10 are expected to drop, this has no effect on the re-entrainment of roadway particles. Mobile source emissions of PM10 are directly related to the amount of daily vehicle miles driven. If VMT does not decline (scenarios a and b), overall particulate emissions may not decline either.

Boulder has pursued progressive winter sanding reduction programs which have the potential to significantly reduce the re-entrained dust component of PM10 These programs will help manage the PM10 problem.

Fine particulate (< 2.5 microns) pollution is a regional problem that is implicated in adverse health effects and reduced environmental visibility. Motor vehicles play a significant role in producing these smaller particles at the tailpipe. For these reasons, continued reduction of mobile source emissions of fine particulate matter should be a local and regional objective.

figure 9-5. particulate emissions



ozone

Regional emissions of nitrogen oxides and hydrocarbons are expected to rise over the next 15 years. Local emissions of nitrogen oxides are predicted to rise under Scenario A, while under Scenario D, a slight decrease is predicted in later years. Hydrocarbon emissions decline marginally under A and D.

9.3 Air Quality Action Plan

The Air Quality Action Plan (AQAP) recommends a number of actions the City of Boulder can take to address air pollution in Boulder and in the region as a whole. These actions are designed to maintain compliance with federal air quality standards, and improve air quality to protect public health and visibility.

The AQAP addresses mobile, stationary, non-road and area sources of air pollution. These source categories include (among others): automobile, businesses, industry, fireplaces, street sanding, charcoal grills and lawn mowers. Controlling emissions from all of these sources is important. However, reducing mobile source emissions is the key component to improving air quality in Boulder and throughout the region.

The development of the Transportation Master Plan Update, the Congestion Relief Study, and the activities of the GO Boulder office move the City towards this goal. The Office of Environmental Affairs will provide support, as needed, to these projects. Beyond support for existing Transportation/ Public Works transportation control and demand projects the AQAP recommends the priority actions shown in figure 9-6 to better understand and control local sources of air pollution.

To track progress which has been made the City will:

- Monitor local pollution levels;
- track air quality indicators such as number of vehicles registered in the City, the change out of old stoves and fireplaces, and sand application to roads;
- monitor state and federal air quality policy initiatives to assure that local and regional strategies are on track;
- identify additional action items to be incorporated into the plan as necessary; and,
- report progress to the City Council and the public through annual air quality reports.

The AQAP will be updated as needed through annual air quality reports. In five years, the City will revisit air quality goals, objectives and strategies; identify areas of additional attention; and set future priorities for the air quality program.

figure 9-6. air quality action plan priority actions

- Expand the City's pollution prevention program, Business Partners for a Clean Environment.
- Amend land use regulations to control air toxics.
- Promote annual air quality agenda at regional and state level.
- Work with local experts to support and conduct local air pollution studies.
- Integrate sustainability and pollution prevention into City operations..
- Expand air quality education.